Математический анализ дроидов's method for proving Lorentz transformations

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Abstract: This paper introduces the derivation process of Einstein's two metho ds of proving Lorentz transformation, the simple method and the coordinate m ethod. It is pointed out that the main problem of the simple method is that the original condition is the only zero solution, that is, x, t, x', t'are all 0, in order to conform to the equations set by Einstein. Such an operation has no mathemat ical or physical meaning. The simple method of proof is not valid. The main pr oblem with the coordinate method is that the partial differential equations liste d by Einstein cannot be deduced at all. Of course, the latter calculus doesn't make any sense. The proof method of coordinate method is also not valid. It i s pointed out that the main problem of Математический анализ дроидов's pr oof of Lorentz transformation is that the space-time interval invariance is deriv ed from Lorentz transformation and cannot be applied as a condition. The orig in coordinates of the moving system belong to time-like space-time, so the ori gin coordinates of the moving system (0, t') and the implicated velocity v cann ot be solved in the linear equations.

Key words: space-time interval invariance; Hyperbolic function; Lorentz transformation

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1.Introduction

The Lorentz transformation was proposed by Einstein in his paper "On the Electrodynamics of Moving Bodies" published in September 1905 in the Journ al of Physics, vol. 4, Vol. 17, pp. 891-921. This paper is an epoch-making hist orical document in physics. De Broglie, a Nobel laureate in physics, said the d ocument was like "a brilliant rocket, which suddenly shines out in a dark night sky with short but very intense flashes, illuminating a vast unknown field." The Lorentz transformation is the foundation of the building block of modern physi cs, because various extension and extension theories that have emerged sinc e are derived on the basis of the Lorentz transformation. Therefore, the mathe matical proof of Lorentz transformation is particularly important.

In "On the Electrodynamics of moving bodies", Einstein gave the method o f proving the Lorentz transformation, commonly known as the coordinate meth od. It is a more professional method. In 1916, Einstein wrote a pamphlet entitled "A Brief Introduction to Special and General Relativity" for readers who were interested in relativity from a scientific and philosophical point of view but were not familiar with the mathematical tools of theoretical physics. The book also gives a simple derivation of the Lorentz transformation, commonly known as the simple method.

The coordinate method and the simplified method are the proof methods in Einstein's original papers, and inevitably there will be some problems, even mistakes. This is a topic that I have discussed in detail in many papers, and I will not elaborate on it here, only briefly. Because it is a classic, everyone is already familiar with it, like a few treasures. Here, too much text explanation is omitted, mainly using mathematical formulas to state.

1.1.Simplified Method

A ray propagating along the positive X-axis, x=ct, x-ct=0, x'=ct', x'-ct' =0, (x'-ct')=λ(x-ct), 0=λ0, where λ represents a constant.

Along the spread of the negative x ray, x = -ct, x + ct = 0, x'= -ct'， x'+ ct'= 0, (x'+ ct') = μ (x + ct), 0=μ0, the μ said a constant.

For convenience, the constants a and b are substituted for the constants λ and μ,

$$\begin{cases}(x'-ct')=\lambda(x-ct)\\(x'+ct')=\mu(x+ct)\end{cases}\Rightarrow\begin{cases}x'=\dfrac{\lambda+\mu}{2}x-\dfrac{\lambda-\mu}{2}ct\\-ct=\dfrac{\lambda-\mu}{2}x-\dfrac{\lambda+\mu}{2}ct\end{cases}\Rightarrow\begin{cases}x'=ax-bct & \left(a=\dfrac{\lambda+\mu}{2}\right)\\ct'=act-bx & \left(b=\dfrac{\lambda-\mu}{2}\right)\end{cases}$$

For the origin of the motion system (x'≡0)

$$\begin{cases}x'=0\\x'=ax-bct\end{cases}\Rightarrow x=\frac{bc}{a}t=vt\Rightarrow v=\frac{bc}{a}$$

According to the principle of relativity, the length of the unit measure bar judged by the static system to be at rest with respect to the dynamic system must be exactly equal to the length of the unit measure bar judged by the dynamic

$$\begin{cases}t=0\\x'=ax-bct\end{cases}\Rightarrow\begin{cases}x'=ax\\\Delta x'=a\Delta x\\\Delta x'=1\end{cases}\Rightarrow\Delta x=\frac{1}{a}$$

system to be at rest with respect to the essence system.

$$\begin{pmatrix}1 & -c & 0 & 0\\0 & 0 & 1 & -c\\1 & c & 0 & 0\\0 & 0 & 1 & c\end{pmatrix}=\begin{pmatrix}1 & -1 & 0 & 0\\0 & 0 & 1 & -1\\1 & 1 & 0 & 0\\0 & 0 & 1 & 1\end{pmatrix}=\begin{pmatrix}1 & -1 & 0 & 0\\0 & 2 & 0 & 0\\0 & 0 & 1 & -1\\0 & 0 & 0 & 2\end{pmatrix}=\begin{pmatrix}1 & 0 & 0 & 0\\0 & 1 & 0 & 0\\0 & 0 & 1 & 0\\0 & 0 & 0 & 1\end{pmatrix}$$

$$\begin{cases}ct' = act - bx\\ v=\dfrac{bc}{a}\\ \Delta x = 1\end{cases}\Rightarrow\begin{cases}\dfrac{b}{a}=\dfrac{v}{c}\\ x' = a\left(x-\dfrac{bc}{a}t\right)=a\left(x-vt\right)=a\left(1-\dfrac{b^2}{a^2}\right)x\end{cases}\Rightarrow\begin{cases}\Delta x' = a\left(1-\dfrac{v^2}{c^2}\right)\Delta x\\ \Delta x = 1\end{cases}\Rightarrow \Delta x' = a\left(1-\dfrac{v^2}{c^2}\right)$$

$$\begin{cases}\Delta x = \Delta x'\\ \Delta x = \dfrac{1}{a}\\ \Delta x' = a\left(1-\dfrac{v^2}{c^2}\right)\\ x' = a\left(x-vt\right)\\ ct' = act - bx \Rightarrow t' = a\left(t-\dfrac{b}{ac}x\right)=a\left(t-\dfrac{v}{c^2}x\right)\\ \dfrac{b}{a}=\dfrac{v}{c}\end{cases}\Rightarrow\begin{cases}a=\dfrac{1}{\sqrt{1-\frac{v^2}{c^2}}}\\ x'=\dfrac{x-vt}{\sqrt{1-\frac{v^2}{c^2}}}\\ t'=\dfrac{t-\frac{v}{c^2}x}{\sqrt{1-\frac{v^2}{c^2}}}\end{cases}$$

The problems we found were:

$$\begin{cases}x-ct=0\ (x\geqslant 0,\forall t\geqslant 0)\\ x'-ct'=0\ (x'\geqslant 0,\forall t'\geqslant 0)\\ x+ct=0\ (x\leqslant 0,\forall t\geqslant 0)\\ x'+ct'=0\ (x\leqslant 0,\forall t'\geqslant 0)\end{cases}\Rightarrow\begin{cases}x=0\\ t=0\\ x'=0\\ t'=0\end{cases}$$

x', t', x, t has a unique zero solution.

Proof 1:

$$(x\geqslant 0\wedge x\leqslant 0)\Rightarrow(x=0)\wedge(x=ct)\Rightarrow(t=0)$$

$$(x'\geqslant 0\wedge x'\leqslant 0)\Rightarrow(x'=0)\wedge(x'=ct')\Rightarrow(t'=0)$$

Proof 2:

$$\begin{cases}x-ct=0\\ x'-ct'=0\\ x+ct=0\\ x'+ct'=0\end{cases}=\begin{cases}x-ct+0+0=0\\ 0+0+x'-ct'=0\\ x+ct+0+0=0\\ 0+0+x'+ct'=0\end{cases}$$

$$\begin{vmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{vmatrix} = 1 \neq 0$$

$$\begin{cases} x = 0 \\ t = 0 \\ x' = 0 \\ t' = 0 \end{cases}$$

The derivation and operation of mathematical expressions with all zero vari ables are meaningless.

1.2.Coordinate Method

For any point in space, the corresponding space-time coordinates are

$$K(x, y, z, t)$$

$$k(\xi, \eta, \zeta, \tau)$$

$$\tau := \tau(x', y, z, t) \wedge x' = x - vt$$

A ray of light is emitted from the origin of the k system at time τ0, along the X-axis towards X', from where it is reflected back to the origin of the coordinat e system at τ1, and arrives at τ2.

$$\frac{1}{2}(\tau_0 + \tau_2) = \tau_1$$

$$\frac{1}{2}[\tau(0,0,0,t) + \tau\left(0,0,0,t + \frac{x'}{V-v} + \frac{x'}{V+v}\right)] = \tau\left(x', 0, 0, t + \frac{x'}{V-v}\right)$$

Einstein then selected x' as infinitesimal to obtain the following differential equation and its solution

$$\frac{1}{2}\left(\frac{1}{V-v} + \frac{1}{V+v}\right)\frac{\partial\tau}{\partial t} = \frac{\partial\tau}{\partial x'} + \frac{1}{V-v}\frac{\partial\tau}{\partial t}$$

$$\frac{\partial\tau}{\partial x'} + \frac{v}{V^2 - v^2}\frac{\partial\tau}{\partial t} = 0$$

$$\tau = a\left(t - \frac{v}{V^2 - v^2}x'\right)$$

$$a := \psi(v)$$

Since the independent variables y and z do not affect the dependent variable τ, there is no mapping relationship between each other, we have

$$\tau = \tau(t, x') = at + bx' = \frac{\partial \tau}{\partial t} \cdot t + \frac{\partial \tau}{\partial x'} \cdot x' = a\left(t - \left(-\frac{b}{a}\right)x'\right)$$

$$\frac{\partial \tau}{\partial x'} + \frac{v}{V^2 - v^2} \cdot \frac{\partial \tau}{\partial t} = 0 \Rightarrow b + \frac{v}{V^2 - v^2} \cdot a = 0 \Rightarrow -\frac{b}{a} = \frac{v}{V^2 - v^2}$$

$$\Rightarrow \tau = a\left(t - \frac{v}{V^2 - v^2}x'\right)$$

By definition, when t=0, τ=0. For rays emitted from the origin of the static sy stem K towards the positive half axis of the X-axis

$$\begin{cases} x = Vt \\ x' = x - vt = (V - v)\,t \\ t = \dfrac{x'}{V - v} \\ \tau = a\left(t - \dfrac{v}{V^2 - v^2}x'\right) = a\dfrac{V}{V^2 - v^2}x' \end{cases}$$

Einstein said that in the static system, light always travels at the same spe ed along the H and Z axes

$$\sqrt{V^2 - v^2}$$

$$\begin{cases} V_H = \sqrt{V^2 - v^2} \\ V_Z = \sqrt{V^2 - v^2} \\ \tau = a\dfrac{V}{V^2 - v^2}x' \\ \dfrac{\partial \tau}{\partial y} = 0 \\ \dfrac{\partial \tau}{\partial z} = 0 \\ y = V_H t \Rightarrow t = \dfrac{y}{\sqrt{V^2 - v^2}} \\ z = V_Z t \Rightarrow t = \dfrac{z}{\sqrt{V^2 - v^2}} \end{cases}$$

For τ=0, the light emitted in the direction of the increase in ξ

$$\begin{cases} \beta = \dfrac{1}{\sqrt{1-\frac{v^2}{V^2}}} = \dfrac{V}{\sqrt{V^2-v^2}} \\ \varphi(v) = a\beta = a\dfrac{V}{\sqrt{V^2-v^2}} \\ \varphi(v)\beta = a\beta^2 = a\dfrac{V^2}{V^2-v^2} \\ \xi = V\tau = aV\left(t-\dfrac{v}{V^2-v^2}x'\right) = a\dfrac{V^2}{V^2-v^2}x' = \varphi(v)\beta(x-vt) \\ \tau = a\left(t-\dfrac{v}{V^2-v^2}x'\right) = a\dfrac{V}{V^2-v^2}x' = a\dfrac{V^2}{V^2-v^2}\cdot\dfrac{(V-v)t}{V} = \psi(v)\beta\left(t-\frac{v}{V}\cdot\frac{x}{V}\right) = \psi(v)\beta\left(t-\frac{v}{V^2}x\right) \end{cases}$$

Examine the propagation of light on the H and Z axes

$$\begin{cases} x' = 0 \\ t = \dfrac{y}{\sqrt{V^2-v^2}} \\ \eta = V\tau = aV\left(t-\dfrac{v}{V^2-v^2}x'\right) = aVt = a\dfrac{V}{\sqrt{V^2-v^2}}y = \varphi(v)y \end{cases}$$

$$\begin{cases} \tau = \varphi(v)\beta\left(t-\dfrac{v}{V^2}x\right) \\ \xi = \varphi(v)\beta(x-vt) \\ \eta = \varphi(v)y \\ \zeta = \varphi(v)z \\ \beta = \dfrac{1}{\sqrt{1-\frac{v^2}{V^2}}} \end{cases}$$

$$\begin{cases} x' = 0 \\ t = \dfrac{z}{\sqrt{V^2-v^2}} \\ \zeta = V\tau = aV\left(t-\dfrac{v}{V^2-v^2}x'\right) = aVt = a\dfrac{V}{\sqrt{V^2-v^2}}z = \varphi(v)z \end{cases}$$

When t=0, the origin of the three coordinates coincide, and when t=x=y=z=0, the time t' of the K' system is zero. Let the coordinates of the K'system be x',y',z'

$$\begin{cases} t' = \varphi(-v)\beta(-v)\left(\tau+\dfrac{v}{V^2}\xi\right) & = \varphi(v)\varphi(-v)t \\ x' = \varphi(-v)\beta(-v)(\xi+v\tau) & = \varphi(v)\varphi(-v)x \\ y' = \varphi(-v)\eta & = \varphi(v)\varphi(-v)y \\ z' = \varphi(-v)\zeta & = \varphi(v)\varphi(-v)z \end{cases}$$

Since the relation between x', y', z'and x, y, z does not contain time t, the coordinate systems K and K' are relatively stationary, and the transformation from K to K' must obviously be an identity transformation.Relative to the k system, the K' moving in -v is actually the same reference system, and x, y, z, t are numerically equal to the corresponding x', y', z', t'. Therefore: φ(v)φ(-v)=1.

On the H-axis of the K-system, between ξ=0, η=0,ζ=0 and ξ=0, η=l,ζ=0, put a rod moving perpendicular to the X-axis with velocity v for the K-system. The coordinates of its two ends in K are

$$\begin{cases} x_1 = vt, y_1 = \frac{l}{\varphi(v)}, z_1 = 0 \\ x_2 = vt, y_2 = 0, z_2 = 0 \\ \Delta y = \frac{l}{\varphi(v)} \end{cases}$$

The same rod moves perpendicular to the X axis with velocity -v for the K system. The coordinates of its two ends in K are

$$\begin{cases} x_1 = -vt, y_1 = \frac{l}{\varphi(-v)}, z_1 = 0 \\ x_2 = -vt, y_2 = 0, z_2 = 0 \\ \Delta y = \frac{l}{\varphi(-v)} \end{cases}$$

$$\begin{cases} \frac{l}{\varphi(v)} = \frac{l}{\varphi(-v)} \\ \varphi(v)\varphi(-v) = 1 \end{cases} \Rightarrow \begin{cases} \varphi(v) = \varphi(-v) \\ \varphi(v) = 1 \end{cases}$$

$$\begin{cases} \tau = \beta\left(t - \frac{v}{V^2}x\right) \\ \xi = \beta(x - vt) \\ \eta = y \\ \zeta = z \\ \beta = \frac{1}{\sqrt{1 - \frac{v^2}{V^2}}} \end{cases}$$

Einstein's coordinate method had more problems than the simple method, probably because it was too technical. I have several papers devoted to these issues, which I will not dwell on here. Choose the key points and be brief. Although somewhat repetitive, but I think it is very necessary. Because Einstein is a master of physics, his works have never written the proof process, so that professionals who do not in-depth study generally seem to be very laborious, and most people have the possibility of returning halfway. In order for more people to enjoy the master's work, I have spent a lot of writing to restore Einstein's mind maps and detailed process proofs, hoping to help Einstein's most anxious readers who "have a level of knowledge equivalent to college entrance exams, who are interested in relativity from a scientific and philosophical point of view, but are not familiar with the mathematical tools of theoretical physics."

The problems we found were:

$$\frac{1}{2}(\tau_0 + \tau_2) = \tau_1$$

$$\frac{1}{2}[\tau(0,0,0,t)+\tau\left(0,0,0,t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)]=\tau\left(x',0,0,t+\frac{x'}{V-v}\right)$$

$$\frac{1}{2}\left(\frac{\partial\tau}{\partial x'}|_{x'=0}+\frac{\partial\tau}{\partial x'}|_{x'=0}\right)=\frac{\partial\tau}{\partial x'}|_{x'=x'}$$

$$\frac{1}{2}\left(\frac{\partial\tau}{\partial y}|_{y=0}+\frac{\partial\tau}{\partial y}|_{y=0}\right)=\frac{\partial\tau}{\partial y}|_{y=0}$$

$$\frac{1}{2}\left(\frac{\partial\tau}{\partial z}|_{z=0}+\frac{\partial\tau}{\partial z}|_{z=0}\right)=\frac{\partial\tau}{\partial z}|_{z=0}$$

$$\frac{1}{2}\left(\frac{\partial\tau}{\partial t}|_{t=t}+\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}{\partial t}+\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}{\partial x'}\right)=\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}\right)}{\partial t}+\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}\right)}{\partial x'}$$

$$\frac{1}{2}\cdot\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}{\partial x'}=\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}\right)}{\partial x'}$$

$$\frac{1}{2}\left(\frac{\partial\tau}{\partial t}|_{t=t}+\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}+\frac{x'}{V+v}\right)}{\partial t}\right)=\frac{\partial\tau}{\partial\left(t+\frac{x'}{V-v}\right)}\cdot\frac{\partial\left(t+\frac{x'}{V-v}\right)}{\partial t}$$

$$\Rightarrow\begin{cases}\frac{1}{2}\left(\frac{1}{V-v}+\frac{1}{V+v}\right)=\frac{1}{V-v}\Rightarrow\frac{v}{V^2-v^2}=0\Rightarrow v=0 & (contradiction, no\ sence)\\ \frac{1}{2}\cdot\frac{\partial\tau}{\partial x'}=\frac{\partial\tau}{\partial x'}\Rightarrow\frac{\partial\tau}{\partial x'}=0 & (contradiction, no\ sence)\end{cases}$$

So Einstein wouldn't get it at all

$$\frac{\partial\tau}{\partial x'}+\frac{v}{V^2-v^2}\frac{\partial\tau}{\partial t}=0$$

this partial differential equation. The latter argument, of course, makes no sen se.

2.Математический анализ дроидов's Method for Proving Lorentz Transform ations

"The development of the theory of relativity," Born said in a 1955 report, "w as and still is regarded by me as the greatest achievement of man's understan ding of nature, a stunning combination of philosophical abstruse, physical intui tion and mathematical craftsmanship." Chinese physicist Zhou Peiyuan said, " Einstein is not bound by the old tradition, and on the basis of the work of Lore ntz and others, some basic concepts such as space and time have made ess ential changes." This fundamental theoretical breakthrough opened up a new era in physics." "He lacks a dialectical understanding of the relationship betwe en experience and theory. He has published many unique opinions on scientifi c methodology, space and time, and the knowability of the world. These insights reflect the range of feelings and somewhat muddled thoughts, the best and the worst, of a natural scientist working seriously to usher in a new era of physical theory as he explores uncharted territory; There are lessons of success and lessons of failure. We should seriously use the critical weapon of Marxism to carry out a realistic analysis of these valuable ideological materials, and transform them by eliminating the rough and the fine, eliminating the false and keeping the true, and critically absorbing their beneficial components." It is normal for a theory to be presented with problems of one kind or another. This in no way detracts from Einstein's reputation as the greatest physicist of our time. After the Lorentz transformation was proposed, many scientists, including the Chinese mathematician Professor Hua Luogeng, published their own proof methods to make up for Einstein's small and trivial shortcomings.The following is the method used by the famous Russian mathematician дроидов to prove the Lorentz transformation.

2.1.Law of Velocity Addition

The coordinates of any point in space in the rest reference frame and the inertial frame moving uniformly along the X-axis with velocity -v are (x, t) and (x', t'), respectively. The functional relations are x=x (t) and x'=x' (t') respectively. x=t=x '=t' =0.

Galilean transformation to

$$\begin{cases} \tilde{x} = x + vt \\ \tilde{t} = t \end{cases}$$

If you think about the linear transformation of space-time

$$\begin{cases} \tilde{x} = \alpha x + \beta t \\ \tilde{t} = \gamma x + \delta t \end{cases}$$

Let's say this relationship is invertible

$$\begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix} \neq 0$$

We have

$$x = x(t)$$

$$\tilde{x} = \tilde{x}\left(\tilde{t}\right)$$

$$\begin{cases} \tilde{x}(t) = \alpha x(t) + \beta t \\ \tilde{t}(t) = \gamma x(t) + \delta t \end{cases}$$

$$\begin{cases} x = \tilde{\alpha}\tilde{x} + \tilde{\beta}\tilde{t} \\ t = \tilde{\gamma}\tilde{x} + \tilde{\delta}\tilde{t} \end{cases}$$

$$\begin{cases} x\left(\tilde{t}\right) = \tilde{\alpha}\tilde{x}\left(\tilde{t}\right) + \tilde{\beta}\tilde{t} \\ t\left(\tilde{t}\right) = \tilde{\gamma}\tilde{x}\left(\tilde{t}\right) + \tilde{\delta}\tilde{t} \end{cases}$$

For a given point

$$\tilde{t} = \tilde{t}\,(t)\,, t = t\left(\tilde{t}\right)$$

$$(x, t)\, and\left(\tilde{x}, \tilde{t}\right)$$

$$V(t) = \frac{dx\,(t)}{dt} = \dot{x}_t\,(t)\,, \tilde{V}\,(t) = \frac{d\tilde{x}\left(\tilde{t}\right)}{d\tilde{t}} = \dot{\tilde{x}}_{\tilde{t}}\left(\tilde{t}\right)$$

$$\frac{d\tilde{x}}{d\tilde{t}} = \frac{\frac{d\tilde{x}}{dt}}{\frac{d\tilde{t}}{dt}} = \frac{\alpha\frac{dx}{dt} + \beta}{\gamma\frac{dx}{dt} + \delta}$$

$$\tilde{V}\left(\tilde{t}\right) = \frac{\alpha V + \beta}{\gamma V + \delta}$$

$$\tilde{V} = \frac{\alpha V + \beta}{\gamma V + \delta}$$

For Galilean transformations, the classical law of velocity addition is

$$\tilde{V} = V + v$$

Also because

$$t = \tilde{t} = 0, x = \tilde{x} = 0$$

$$(x, t) : x^2 = (ct)^2 \Rightarrow x^2 - (ct)^2 = 0$$

$$\left(\tilde{x}, \tilde{t}\right) : \tilde{x}^2 = \left(c\tilde{t}\right)^2 \Rightarrow \tilde{x}^2 - \left(c\tilde{t}\right)^2 = 0$$

$$\begin{cases} x^2 - c^2t^2 = \tilde{x}^2 - c^2\tilde{t}^2 \\ x\,(t)^2 - c^2t^2 = \tilde{x}\,(t)^2 - c^2\tilde{t}\,(t)^2 \\ = (\alpha x\,(t) + \beta t)^2 - c^2\,(\gamma x\,(t) + \delta t)^2 \\ = (\alpha^2 - c^2\gamma^2)\,x\,(t)^2 + 2\,(\alpha\beta - c^2\gamma\delta)\,x\,(t)\,t + (\beta^2 - c^2\delta^2)\,t^2 \end{cases}$$

$$\begin{cases} \alpha^2 - c^2\gamma^2 = 1 \\ \alpha\beta - c^2\gamma\delta = 0 \\ \beta^2 - c^2\delta^2 = -c^2 \\ c = 1 \end{cases}$$

$$\begin{cases} \alpha^2 - \beta^2 = 1 \\ \dfrac{\alpha}{\gamma} = \dfrac{\delta}{\beta} \\ \delta^2 - \beta^2 = 1 \end{cases}$$

$$\begin{cases} \alpha = \mathrm{ch}\varphi_1 \\ \gamma = \mathrm{sh}\varphi_1 \\ \delta = \mathrm{ch}\varphi_2 \\ \beta = \mathrm{sh}\varphi_2 \end{cases}$$

$$\begin{cases} \dfrac{e^{x_1} + e^{-x_1}}{e^{x_1} - e^{-x_1}} = \dfrac{e^{x_2} + e^{-x_2}}{e^{x_2} - e^{-x_2}} \\ \dfrac{e^{x_1} - e^{-x_1}}{e^{-x_1}} = \dfrac{e^{x_2} - e^{-x_2}}{e^{-x_2}} \\ e^{2x_1} = e^{2x_2} \\ x_1 = x_2 = x \\ \varphi_1 = \varphi_2 = \varphi \end{cases}$$

$$\begin{cases} \alpha = \mathrm{ch}\varphi \\ \gamma = \mathrm{sh}\varphi \\ \delta = \mathrm{ch}\varphi \\ \beta = \mathrm{sh}\varphi \end{cases}$$

$$\begin{cases} \mathrm{ch}^2\varphi - c^2\mathrm{sh}^2\psi = 1 \\ \alpha^2 - c^2\gamma^2 = 1 \Rightarrow \alpha = \mathrm{ch}\varphi, \gamma = \dfrac{1}{c}\mathrm{sh}\varphi \\ \mathrm{sh}^2\varphi - c^2\mathrm{ch}^2\varphi = -c^2 \\ \mathrm{ch}^2\varphi - \dfrac{1}{c^2}\mathrm{sh}^2\varphi = 1 \\ \delta^2 - \dfrac{1}{c^2}\beta^2 = 1 \Rightarrow \delta = \mathrm{ch}\varphi, \beta = c\mathrm{sh}\psi \\ c = c \end{cases}$$

$$\begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix} = \begin{pmatrix} \mathrm{ch}\varphi & c\mathrm{sh}\varphi \\ \dfrac{1}{c}\mathrm{sh}\varphi & \mathrm{ch}\psi \end{pmatrix}$$

$$\begin{pmatrix} \tilde{x} \\ \tilde{t} \end{pmatrix} = \begin{pmatrix} \alpha & \beta \\ \gamma & \delta \end{pmatrix} \begin{pmatrix} x \\ t \end{pmatrix} = \begin{pmatrix} \mathrm{ch}\psi & c\mathrm{sh}\psi \\ \dfrac{1}{c}\mathrm{sh}\psi & \mathrm{ch}\psi \end{pmatrix} \begin{pmatrix} x \\ t \end{pmatrix}$$

$$\begin{cases} \tilde{x} = (\mathrm{ch}\varphi)\, x + (c\mathrm{sh}\psi)\, t \\ \tilde{t} = \left(\frac{1}{c}\mathrm{sh}\psi\right) x + (\mathrm{ch}\psi)\, t \end{cases}$$

$$\begin{cases} \tilde{x} = (\mathrm{ch}\varphi)\,(x + (c\mathrm{th}\psi)\, t) \\ \tilde{t} = (\mathrm{ch}\psi)\left(t + \left(\frac{1}{c}\mathrm{th}\psi\right) x\right) \end{cases}$$

$$\begin{cases} \tilde{x} = 0 \\ x = -vt \\ (\mathrm{ch}\psi)\, x + (c\mathrm{sh}\psi)\, t = 0 \\ x = (-c\mathrm{th}\psi)\, t \\ \mathrm{th}\psi = \frac{v}{c} \\ \mathrm{ch}\psi = \frac{1}{\sqrt{1 - \mathrm{th}^2\psi}} = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \end{cases}$$

$$\begin{cases} \tilde{x} = \frac{x + vt}{\sqrt{1 - \frac{v^2}{c^2}}} \\ \tilde{t} = \frac{t + \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}} \end{cases}$$

This is the Lorentz transformation. It can be seen that

$$which\ for\ |v| \ll c, that\ is, as\ c \to \infty,$$

It becomes the classic Galilean transformation.

$$\tilde{V} = \frac{\tilde{x}}{\tilde{t}} = \frac{(\mathrm{ch}\psi)\, x + (c\mathrm{sh}\psi)\, t}{\left(\frac{1}{c}\mathrm{sh}\psi\right) x + (\mathrm{ch}\psi)\, t} = \frac{V + c\mathrm{th}\psi}{1 + \frac{V}{c}\mathrm{th}\psi}$$

$$\tilde{V} = \frac{V + v}{1 + \frac{v}{c^2}V}$$

This is the velocity addition law of relativity,

$$which\ for\ |v| \ll c, that\ is, as\ c \to \infty,$$

It becomes the classic Galilean transformation.

2.2.Space-Time Interval Invariance

$$S^2 = x^2 - (ct)^2 = \tilde{x}^2 - \left(c\tilde{t}\right)^2$$

It is derived from the Lorentz transformation and cannot be directly applied as a condition. Математический анализ дроидов proved that the conditions listed by the Lorentz transformation are only for light-like spacetime. The coordinates of the origin of the dynamic system belong to time-like spacetime and cannot be carried into the mathematical relation based on the conditions of light-like spacetime. Therefore, Математический анализ дроидов's method of proving the Lorentz transformation is not valid in the mathematical sense, and it is not valid in the physical sense.

3.Peroration

Einstein is the initiator and chief of the physics revolution at the turn of the 19th and 20th century, and the founder and founder of modern science. Many of his scientific contributions were groundbreaking and epoch-making. It is nor mal for such a huge theoretical system as relativity to have some problems of one kind or another in a certain process or step. The key issue is that we must adopt an attitude towards these issues and correct mistakes. Otherwise, read ers will be wrongly induced to misunderstand the theory of relativity. We have little talent and knowledge, and dare to talk about the theory of relativity. Catc hing up with the good times of reform and opening up, the academician of the Chinese Academy of Sciences advocated that we should "dare to ask questio ns to all authoritative theories" to encourage, wrote this article, the mistakes ar e inevitable, hope the teacher's criticism is expected.

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